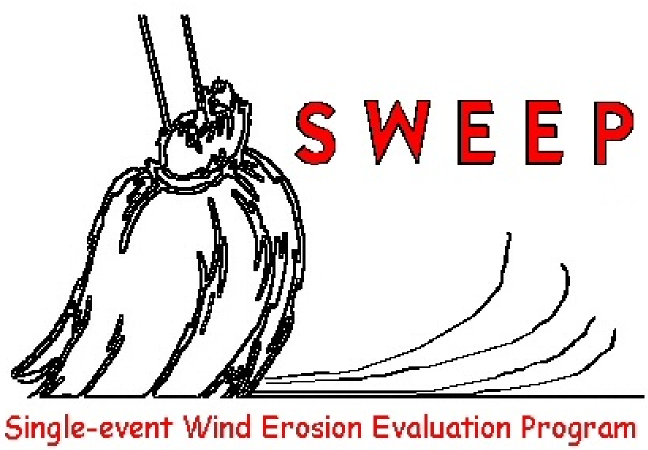
Single-event Wind Erosion Evaluation Program

SWEEP



User Manual
DRAFT

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Introduction

The Single-event Wind Erosion Evaluation Program (SWEEP) is a process-based computer model that simulates wind erosion for a single-day storm event. The model consists of the EROSION submodel of the Wind Erosion Prediction System (WEPS) model coupled with a simple graphical user interface.

Installation

SWEEP can be downloaded at: www.weru.ksu.edu/weps
This is the WEPS model web page from which one can download a number of WERU products. The process to download the SWEEP model only is described next.

Click 'Downloads' at the top of the screen. This will take you to WEPS Download Registration screen. After entering registration information you will proceed to the Downloads Page for WEPS. Click the latest WEPS version to download the installation program. The download file consists of an executable file that will allow the user to install WEPS and SWEEP products onto your Windows computer. When you install and get to the 'Setup Type" screen, choose the 'Custom Installation' option and be sure to at least choose the options (i.e., remove the red X) for the 'SWEEP'. Follow the prompts to install SWEEP on your computer. Of course you are free to install any other options you wish. This process will put an icon on your computer desktop for the options you chose as well as make them accessible through "Start>Programs>USDA Applications".

Contact WERU if you need assistance at:

Phone: 785-537-5559
E-mail: weps@weru.ksu.edu

SWEEP Science

Introduction
This section briefly describes the science behind the Single-event Wind Erosion Evaluation Program (SWEEP). The science portion of SWEEP, is the EROSION submodel of the Wind Erosion Prediction System (WEPS). For an in-depth description of the equations used in this model, see the WEPS Erosion Submodel Technical Description (Hagen, 1995).

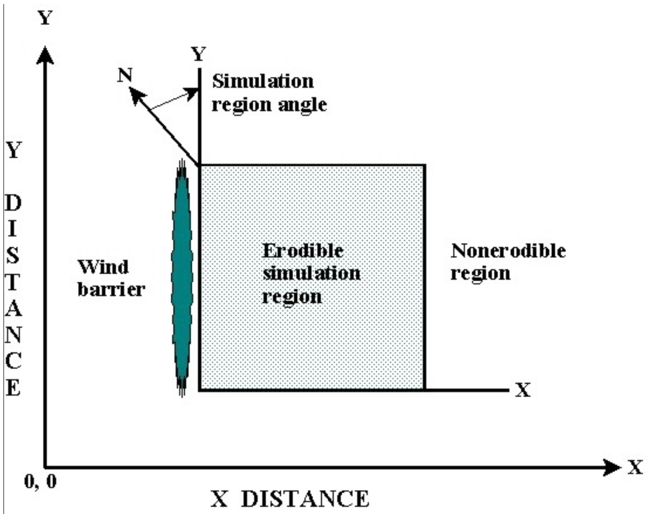

Figure 1.1. Schematic of simulation region geometry. Field orientation, end points of barriers, and opposite corners of the rectangular simulation region are input to the SWEEP model.

The objective of the SWEEP model is to simulate the components of soil loss/deposition over a rectangular field in response to wind speed, wind direction, field orientation, and surface conditions, on a sub-hourly basis (Fig. 1.1). In SWEEP, barriers may be placed on any or all field boundaries. When barriers are present, the wind speed is reduced in the sheltered area on both the upwind and downwind sides of the barriers. The model determines the threshold friction velocity at which erosion can begin for each surface condition. When wind speeds exceed the threshold, the model calculates the loss/deposition over a series of individual grid cells representing the field. The soil/loss deposition is divided into components of saltation/creep and suspension, because each has different transport modes, as well as off-site impacts. Finally, the field surface is periodically updated to simulate the changes caused by erosion.

Parameters Describing Soil Surface Conditions
Surface roughness is represented by both random roughness and oriented roughness. The parameters used are standard deviation of the surface heights for random roughness and the height, width of ridge tops, and spacing of ridges for oriented roughness.

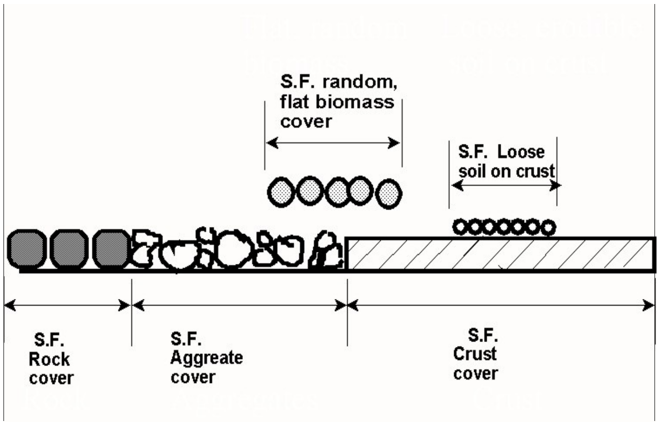

Figure 1.2. Diagram illustrating components of flat surface cover inputs to the SWEEP model.

Surface cover is represented at three levels (Fig. 1.2). At the first level, surface rock, aggregates and crust compose 100 percent of the cover. At the second level, the parameter is the fraction of the crusted surface covered with loose, erodible soil. When there is no crust, this parameter is zero. At the third level, the parameter is the fraction of total surface covered by flat, random biomass.

The aggregate density and size distribution are soil parameters that determine soil mobility. The dry mechanical stabilities of the clods and crust are input parameters that indicate their resistance to abrasion from impacts by eroding soil. Surface soil wetness is also input and used to increase the threshold friction velocity at which erosion begins.

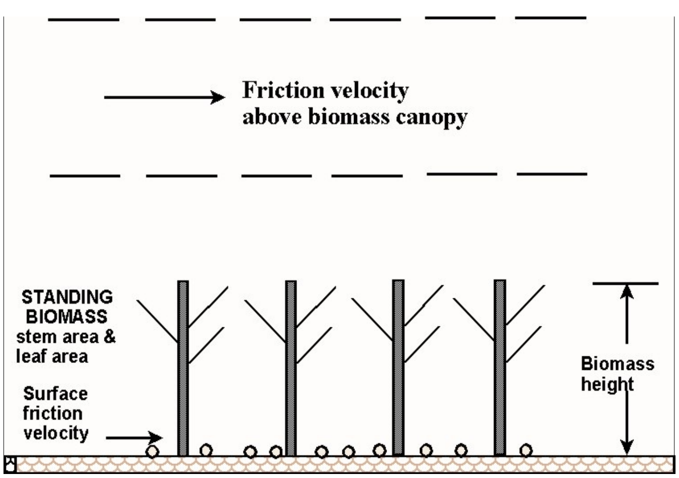

Figure 1.3. Diagram illustrating friction velocity above standing biomass that is reduced by drag of stems and leaves to the surface friction velocity below the standing biomass.

Uniformly distributed standing biomass is 5 to 10 times more effective in controlling wind erosion than is flat biomass, and thus, standing biomass is treated separately. The wind friction velocity above standing biomass is depleted by the leaves and stems to obtain the friction velocity at the surface that is used to drive erosion (Fig. 1.3). Leaves are represented by a leaf area index and stems are represented by a stem silhouette area index.

Erosion Processes Simulated

Soil transport during wind erosion occurs in three modes: creep-size aggregates, 0.84 to 2.0 mm (0.033 - 0.079 in.) in diameter, roll along the surface; saltation-size aggregates, 0.10 to 0.84 mm (0.004 - 0.033 in.) in diameter, hop over the surface; and suspension-size aggregates, less than 0.01 mm (0.004 in.) in diameter, move above the surface in the turbulent flow.

Variations in friction velocity, aggregate density, and sediment load obviously may change the mass of aggregates moving in a given mode. Saltation and creep are simulated together because they have a limited transport capacity that depends mainly upon friction velocity and surface roughness. The suspension component is simulated with no upper limit on its transport capacity at the field scale. A portion of the suspension component is simulated as PM-10 (i.e., particulate matter less than 10 micrometers (0.0004 in.) in diameter), which is regulated as a health hazard.

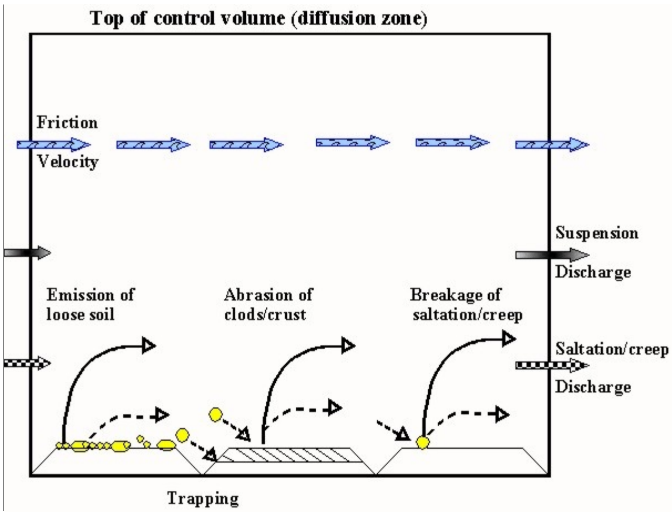

Figure 1.4. Diagram illustrating processes simulated by the EROSION submodel on a bare soil surface in an individual grid cell.

Multiple physical erosion processes are simulated in the SWEEP model, and these are illustrated for a single grid cell in Fig. 1.4. The two sources of eroding soil are emission of loose soil and entrainment of soil abraded from clods and crust. These sources are apportioned between saltation/creep and suspension components on the basis of the source process and soil characteristics. Three processes deplete the amount of moving saltation/creep. These include trapping in surface depressions, interception by plant stems/leaves, and breakage of saltation/creep size particles and aggregates into suspension-size.

Simulation of surface rearrangement is accomplished by allowing emissions to deplete the loose soil and armor the surface in the upwind field area. In contrast, processes such as abrasion of the protruding aggregates and trapping in depressions dominate in downwind areas and lead to smoothing the surface and a build-up of loose saltation/creep. A build-up of saltation/creep often occurs, because the transport capacity may be satisfied, but abrasion of clods/crust continues to create additional saltation/creep-size soil.

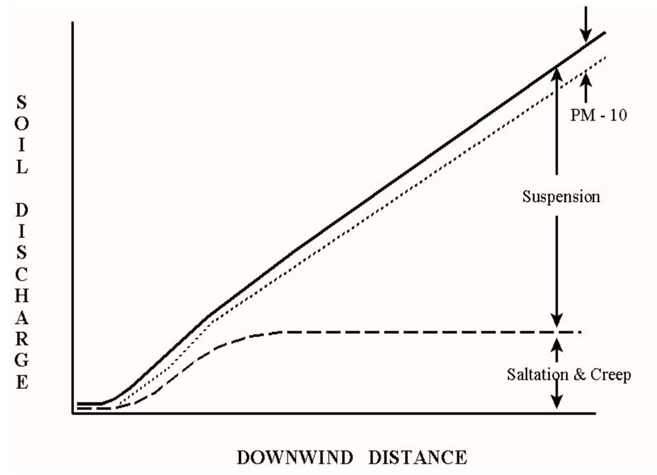

Figure 1.5. Diagram illustrating downwind transport capacity for saltation & creep, but a continuing increase in transported mass of suspension-size soil downwind.

Typical behavior of the downwind soil discharge simulated along a line transect for the saltation/creep and suspension components is illustrated in Fig. 1.5. The suspension component keeps increasing with downwind distance, even though saltation/creep reaches transport capacity. This is because the sources for suspension-size soil are usually active over the entire field. These sources include emissions from impacts on loose soil, abrasion from clods/crust, and breakage from impacting saltation/creep-size aggregates. Moreover, the suspension component has a transport capacity many times larger than that of saltation/creep, so on large fields it is the 'freightliner' for moving soil whereas saltation/creep is merely the 'pickup truck'. The vertical extent of the suspension component at transport capacity is on the order of a few kilometers while the vertical limit of saltation/creep is on the order of approximately one meter.

Outputs

The SWEEP model calculates total, suspension, and PM-10 soil loss/deposition at each grid cell in the field. The grid cell data are summarized reported to users as averages over the field for selected periods. The model also calculates the components of soil discharge crossing each field boundary. These are reported to users, according to the size ranges of aggregates as saltation/creep, suspension, and PM-10. These latter outputs are useful for evaluating off-site impacts in any given direction from the eroding field.

Interface Reference

The installation process described previously, should put the SWEEP icon on your desktop, if you chose that option, as well as make the program accessible through "Start>Programs>USDA Applications". Click the desktop icon or access the program through the "Start" menu to begin the SWEEP interface. The SWEEP interface (Fig. 1.6) consists of a menu bar and several input screens arranged in tabs across the top of the screen.

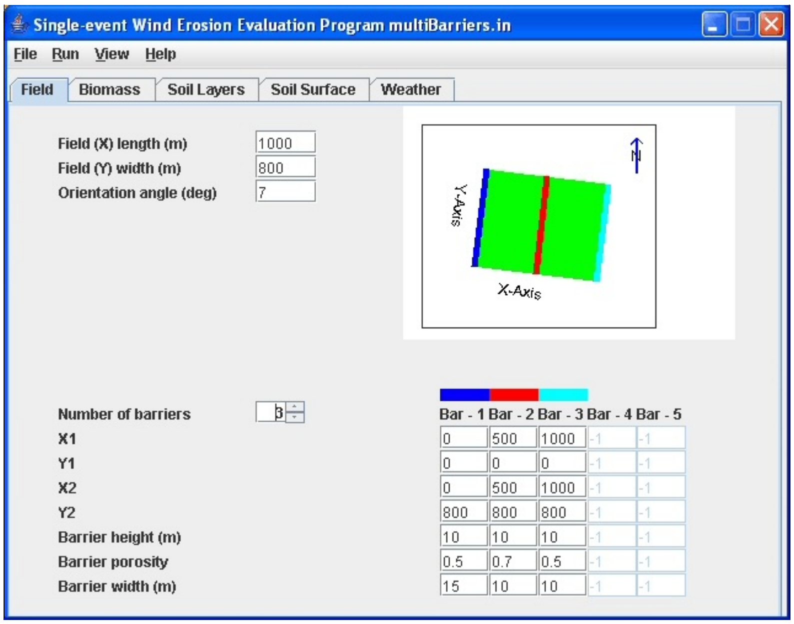

Figure 1.6. The main SWEEP screen showing the Field tab.

Menu Bar

The menu bar is at the top of the SWEEP screen to allow easy access to the main functions of the model. Each item on the menu bar is described next.

File
The '**File**' menu is a drop down list of various computer operations pertaining to SWEEP files. The File menu contains the following options:

- **New** - allows user to create a new input file from scratch.
- **Open** - allows user to open an existing input file.

- **Save** - saves the currently displayed input file to its current file name.

- **Save As** - saves the currently displayed input file under a different file name.

- **Load Soil File** - opens a file chooser to select a WEPS generated soil file (*.ifc) which is then used to populate the soil tabs.

- **Load SSURGO File -** opens a list of soils previously obtained from the NRCS Soil Survey Geographic (SSURGO) database. This opens a window titled '**Select SSURGO Soil**'. Navigate through the database tree to find the soil survey area (or county) desired then select a soil. A full description of how to navigate to select a soil as well as how to download soil data from the SSURGO database and convert them to the correct file format is available in the Appendix of the SWEEP User Guide.

- **Exit** - exit the SWEEP program.

Run
This allows the user to run SWEEP using the current inputs specified on the SWEEP screen. Before running a SWEEP simulation, the user should save the input file first. The '**Run**' menu on the SWEEP screen displays the following option:

- '**Run**' - begin a SWEEP simulation using the current selected inputs.

View
This menu allows the user to view input or output for the most recent (i.e., most current) SWEEP run. The **View** menu on the SWEEP screen displays the following options:

- '**Input Text**' - clicking on this menu item displays the current input file.

- '**Output Text**' - clicking on this menu item displays the most recent output file.

- '**Graph**' - clicking on this menu item displays the Sweep Soil Erosion Viewer that allows the user to view 3-D plots of various SWEEP outputs.

Help
This menu contains help options for SWEEP, including:

- '**About**' - displays the Build Date, Release Number, and Java Runtime Version used for SWEEP.

- '**Help**' - displays a window containing the SWEEP online help system.

Tabs

Each item on each tab is described next. A range of absolute values, which are valid for SWEEP, are given for each parameter where applicable. Values out of range have not been extensively tested and effects on model outputs are unknown. Methods for estimating some parameters from known soil properties are also given.

Field Tab

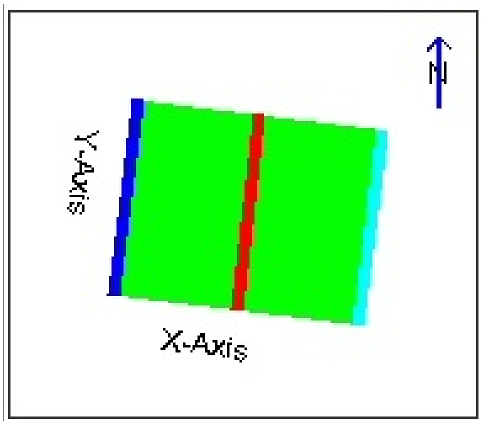

Figure 1.7. Field View panel for a rectangular field.

The Field tab describes the field and barrier dimensions and orientation. A Field View panel (Fig. 1.7) is located to the upper right of the SWEEP Field tab. This panel is for viewing only and is not editable. It is designed to give the user a view of the field size, shape, and orientation (green). The placement of any barriers present is also displayed. The color of the displayed barrier corresponds to the color displayed over the barrier properties column for that barrier. Only barriers parallel to the field borders are allowed. The field tab parameters are defined next. Note that although up to five barriers may be simulated, barriers within the field borders have not been extensively tested.

Field (X) length - The length of the simulation region in the X-direction, meters.
Absolute range: 10.0 to 1600.0

Field (Y) length - The length of the simulation region in the Y-direction, meters.
Absolute range: 10.0 to 1600.0

Orientation angle - Orientation of the simulation region in degrees, clockwise from North.
Absolute range: 0.0 to 360.0

Number of barriers - The number of barriers within the filed and on the field borders.
Absolute range: 0 to 5

X1 - The first X coordinate of the linear barrier end point, meters.
Absolute range: 0.0 to field length in the X direction

Y1 - The first Y coordinate of the linear barrier end point, meters.
Absolute range: 0.0 to field length in the Y direction

X2 - The second X coordinate of the linear barrier end point, meters.
Absolute range: 0.0 to field length in the X direction

Y2 - The second Y coordinate of the linear barrier endpoint, meters.
Absolute range: 0.0 to field length in the Y direction

Barrier height - The average height of the barrier, meters.
Absolute range: 0.0 to ?

Barrier porosity - The Average barrier optical porosity (1.0 - silhouette area), m^2/m^2.
Absolute range: 0.0 to 1.0 (i.e., 1.0 = solid barrier)

Barrier width - The average width of the barrier, meters
Absolute range: 0.0 to ?

Biomass Tab

The Biomass tab describes the crop and biomass conditions on the soil surface.

Residue average height - The average height of standing residue, meters
Absolute range: 0.0 to 3.0

Residue stem area index - The residue stem area index, m^2/m^2
Absolute range: 0.0 to 3.0

Residue leaf area index - The residue leaf area index, m^2/m^2
Absolute range: 0.0 to 3.0

Residue flat cover - The flat biomass cover, m^2/m^2
Absolute range: 0.0 to 1.0

Growing crop average height - The average height of the growing crop, meters

Absolute range: 0.0 to 3.0

Growing crop stem area index - The growing crop stem area index, m^2/m^2
Absolute range: 0.0 to 3.0

Growing crop leaf area index - The growing crop leaf area index, m^2/m^2
Absolute range: 0.0 to 12.0

Row spacing - The row spacing cover, meters. Use a value of 0.0 if not planted in rows (e.g., broadcast seeded).
Absolute range: 0.0 to ?

Seed placement - Specify location of seed as either on the ridge top or in the bottom of the furrow. The value doesn't matter if no ridges exist or if broadcast seeded.

Soil Layers Tab

The Soil Layers tab describes the soil properties in each layer of the soil. Note that the current version of SWEEP only accounts for the surface layer properties when simulating erosion. Simulating erosion for lower layers is described at the end of the Soil Layers tab discussion.

Number of layers - The number of soil horizons or layers for which properties are reported. NOTE: Only the top layer (layer 1) is used in the current version of SWEEP.
Absolute range: 1 to 10

Thickness - The thickness of each soil layer, millimeters.
Absolute range: 0.0 to ?

Bulk density - The oven dry weight of the less than 2 mm soil material per unit volume of dry soil , Mg/m^3.
Absolute range: 0.8 to 1.6

Sand fraction - Mineral particles 0.05 to 2.0 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction, kg/kg.
Absolute range: >0.0 to 1.0
Estimated by: sand = 1.0 - (silt + clay)

Very fine sand fraction -	Mineral particles 0.05 to 0.1 mm in equivalent diameter as a weight fraction of the less than 2 mm fraction, kg/kg. Absolute range: 0.0 to 1.0
Silt fraction -	Mineral particles 0.002 to 0.05 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction, kg/kg. Absolute range: >0.0 to 1.0 Estimated by: silt = 1.0 - (sand + clay)
Clay fraction -	Mineral particles less than 0.002 mm in equivalent diameter as a weight fraction of the less than 2.0 mm fraction, kg/kg. Absolute range: >0.0 to 1.0 Estimated by: clay = 1.0 - (silt + sand)
Rock volume fraction -	The volume fraction of the layer occupied by the 2.0 mm or larger (20 mm or larger for wood fragments) on a whole soil basis (m^3 /m^3). Absolute range: 0.0 to 1.0
Avg aggregate density -	The oven dry weight of the less than 2 mm soil aggregates per unit volume of dry soil aggregates, Mg/m^3. Absolute range: 0.6 to 2.5 Estimated by: ag den = 2.01 *(0.72 + 0.00092 * layer depth) for layer depth < 300 mm ag den = 2.0 for layer depth > 300 mm
Avg dry aggregate stability -	Mean of natural log of aggregate crushing energies, ln(J/kg) . Absolute range: 0.1 o 7.0 Estimated by: ag stab = 0.83 + 15.7 * clay - 23.8 * clay ^{2}

GMD of aggregate sizes - Soil aggregate geometric mean diameter of the modified log-normal distribution (mm).
Absolute range: 0.03 to 30.0
Estimated by: ag gmd = exp(l.343 - 2.235 * sand - 1.226 * silt - 0.0238*sand/clay ^{3} + 33.6 * om + 6.85*CaCO)*(1.0 +0.006*layer depth)

GSD of aggregate sizes - Soil aggregate geometric standard deviation of the modified log-normal distribution, dimensionless.
Absolute range: 1.0 to 20.0
Estimated by: ag gsd = 1.0 / (0.0203 + 0.00193(aggr. gmd) + 0.074 / (aggr.gmd) $^{0.5}$)

Minimum aggregate size - Lower limit of the modified log-normal aggregate size distribution, mm.
Absolute range: 0.001 to 5.0
Estimated by: ag min = 0.01

Maximum aggregate size - Upper limit of the modified log-normal aggregate size distribution, mm.
Absolute range: 1.0 to 1000.0
Estimated by: ag max = (ag gsd) * (ag gmd) + 0.84 ^{p}
where p = 1.52 * (ag gsd)$^{-0.449}$

Soil wilting point water content - The amount of soil water retained at 15 bars (1500 kPa), expressed as a percentage of the less than 2 mm, oven-dry soil by volume, Mg/Mg.
Absolute range = 0.0 to ??
Estimated by: Saxton, et al. (1986)

Soil wilting point water content - The amount of soil water retained at 15 bars (1500 kPa), expressed as a percentage of the less than 2 mm, oven-dry soil by volume, Mg/Mg.
Absolute range = 0.0 to ??
Estimated by: Saxton, et al. (1986)

At the bottom of the ‘Soil Layers’ tab are two arrows. The left arrow [<<] can be used to cycle the lower layers to the surface. This may be useful in simulating fields that have had their surfaces removed, such as for construction. The right arrow [>>] cycles the layers down creating a “blank” layer at the surface. This may be useful in simulating an amendment to the original surface. Note! This function cannot be reversed and the user may have to reload the soil if the layers are cycled past the desired layer. The user is therefore advised to save the soil file before performing any cycling of layers to avoid loss of soil data.

Soil Surface Tab

The Soil Layers tab describes the physical properties of the soil surface.

Surface crust fraction - Fraction of surface covered with consolidated soil, as opposed to aggregated soil, m^2/m^2.
Absolute range = 0.0 to 1.0

Surface crust thickness - Average thickness of the consolidated zone in the surface layer, mm.
Absolute Range: 0.0 to 23.0

Loose material on crust - Fraction of total crusted surface area covered with loose material on the crust m^2/m^2.
Absolute range = 0.0 to 1.0

Loose mass on crust - Mass of the loose, saltation-size soil on top of the surface crusted area, kg/m^2.
Absolute range = 0.0 to 3.0
Estimated by: 0.0

Crust density - The density of the soil crust (Mg/m^3).
Absolute range = 0.6 to 2.0
Estimated by: aggregate density

Crust stability - Mean of natural log of crust crushing energies, ln(J/kg).
Absolute range = 0.1 to 7.0
Estimated by: aggregate stability

Allmaras random roughness - The standard deviation of elevation from a plane of a random soil surface, including any flat biomass adjusted as suggested by Allmaras et al. (1966), mm.
Absolute range = 1.0 to 70.0
Estimated by: See the chapter "Using WEPS in Conservation Planning" in the WEPS User Manual for a visual estimation method.

Ridge height - The height of soil ridges from bottom of furrow to top of ridge, mm. NOTE: If no ridges, then specify 0.0.
Absolute range = 0.0 to 500.0
Estimated by: 0.0

Ridge spacing - Spacing between ridge tops, mm. NOTE: If no ridges, then specify 0.0.
Absolute range = 10.0 to 2000.0.
Estimated by: 10.0

Ridge width - Width of the top of the ridge (i.e. bed width), mm. NOTE: If no ridges, then specify 0.0.
Absolute range = 10.0 to 4000.0
Estimated by: 10.0

Ridge orientation - Direction parallel to the tillage ridge, clockwise from true north, degrees. (i.e., North/South = 0.0 or 180, East/West = 90.0)
Absolute range = 0.0 to 180.0
Estimated by: 0.0

Dike spacing - Spacing between dikes in the furrow, mm. NOTE: If no dikes, then specify 0.0.
Typical Range: 0.0 to 1000.0

Dike spacing - Spacing between dikes in the furrow, mm. NOTE: If no dikes, then specify 0.0.
Typical Range: 0.0 to 1000.0

Snow depth - Average depth of snow on the soil surface, mm.
Typical Range: 0.0 to 1000.0

Hourly surface water content - The near surface water content for each hour of the day, Mg/Mg.
Absolute Range: 0.0 to 0.50

<u>Weather Tab</u>

The Weather tab describes the weather parameters for the simulation location.

Air density - The average density of the air at the simulation location for the day, kg/m^3.

Absolute Range: 0.7 to 1.5

Wind direction - Wind direction (degrees) for the 1 to 3 periods of the day with the fastest wind speeds, measured clockwise from North.

Typical Range: 0.0 to 359.9

Number of intervals/day to run EROSION -

The number of time steps erosion is calculated for each day. The is equal to the number of wind speeds input for the day. Note:

no. time step = 24 means hourly updates
no. time step = 48 means 30 minute updating
no. time step = 96 means 15 minute updating
Absolute range: 24 to 96

Anemometer height - The height of the anemometer above the soil surface at which the wind speeds were measured, m

Absolute range: 0.5 to 30.0

Aerodynamic roughness at anemometer site -

Aerodynamic roughness at the site where wind speeds were measured, mm

Absolute Range: 0.5 to 2000.0

Zo location flag - Select the location where the wind data was measured: either measured at a weather station that was remote from the simulation site or measured at the field simulation site. If at weather station location - Zo is a constant. If on the field location - zo varies based on field surface

Wind/Weibull selection - Select to either read in Weibull parameters for the location used to simulate wind speeds or select to enter measured wind speeds.

Fraction of time winds are calm -	The fraction of time intervals that are calm for the day, hr/hr. NOTE: This is only available when "Weibull" is selected. Absolute range: 0.0 to 1.0
Weibull "c" factor -	The scale parameter "c" for the Weibull distribution describing the wind speed distribution for the site, m/s. NOTE: This is only available when "Weibull" is selected. Absolute range: 0.0 to 30.0
Weibull "k" factor -	The shape parameter "k" for the Weibull distribution describing the wind speed distribution for the site, unitless. NOTE: This is only available when "Weibull" is selected. Absolute range: 1.0 to 3.0
Wind table -	Wind speeds for each time interval of the day, m/s. Wind data are typically averages for the period. More frequent than hourly estimates of wind speed will likely improve accuracy of estimated erosion. Likewise the maximum "instantaneous" wind speed for each time period is better than an hourly average. Notes: The number of wind speeds must equal the "Number of intervals/day to run EROSION" parameter entered previously. This is only available when "Wind" is selected. Each wind speed must be delimited by a tab or white space. Absolute range: 0.0 to ??

Making a SWEEP Run

All available input parameters must have a value for SWEEP to successfully run. The user has three options for populating the input parameters on the tabs. One may, 1) open a previously saved run, which may be run as is or parameters may be modified and then run, 2) load a soil file which populates soil dependent parameters allowing the user to populate remaining parameters, 3) populate all parameters from scratch. The user must save newly created run parameters under a file name through the File menu prior to a run. If the user tries to make a run without saving parameters to a file, a prompt will appear asking the user to save the data to a file. Note that known characters that are invalid in SWEEP file names include: \ / < > | ? * & " ~ ` '

When available input parameters have been populated within each tab and the file saved, selecting 'Run' from the Run menu begins a SWEEP simulation. You may briefly see a run dialog window appear on the screen during the simulation run. A run typically takes less than a few seconds.

Viewing Outputs

After the run completes, the user may click the "View" menu to select options to view the input file parameters, view the text output file, or open the Soil Erosion Viewer, a simple 3-D graphical program to view plots of the grid data. The output file is placed by default in the same directory as the input file and has the same name as the input file name with a '.egrd' extension.

The output file is the raw output from the model and has in-line documentation describing each section of output. The output file provides the following information. First, it echoes the input values. It then provides erosion loss (kg/m of border width) passing each border of the field in terms of total, creep+saltation, suspension, and PM10. Next, it provides the amount of soil leaving each field grid cell in terms of total, creep+saltation, suspension, and PM10. Negative values are a net loss and positive values are a net gain (i.e., deposition). Finally it gives averages for field and boundary losses for total, creep+saltation, suspension, and PM10.

Soil Erosion Viewer

The SWEEP Soil Erosion Viewer (Fig. 1.8) is a simple graphical viewer that provides 3-D plots and data of field grid output. It is accessed using the "Graph" menu item under the

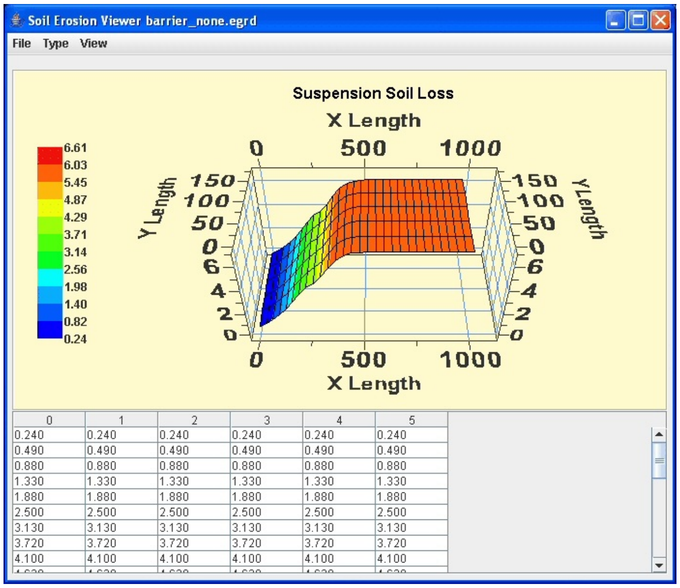

Figure 1.8. The Soil Erosion Viewer screen.

SWEEP View menu bar option. Right clicking within the graph area displays formatting and other customizing options for the viewer. A menu at the top of the Soil Erosion Viewer screen provides the following graphing functions.

File

The '**File**' menu is a drop down list of various computer operations pertaining to SWEEP Soil Erosion Viewer. The File menu contains the following options:

- **Open** - allows user to open an existing output file into the SWEEP Soil Erosion Viewer.
- **Exit** - exits the SWEEP Soil Erosion Viewer.

Type

This menu item allows the user to select various SWEEP outputs to plot. Click a 'radio button' to select for plots of Total, Creep/Saltation, Suspension, or PM10 soil loss from the field grid cells.

View
This menu item allows the user to rotate the graphical view. Click a ‘radio button’ to rotate the plot view to the right or to the left.

References

Allmaras R.R., R.E. Burwell, W.E. Larson, and R.F. Holt. 1966. Total porosity and random roughness of the interrow zone as influenced by tillage. USDA Conservation Research Report 1966, Vol. 7, p. 1-22.

Hagen, L.J. 1995. Wind Erosion Prediction System (WEPS) Technical Description: Erosion submodel. Proceedings of the WEPP/WEPS Symposium. Soil and Water Conservation Society, Ankeny, IA.

Saxton, K. E., W.J. Rawls, J.S. Romberger, and R. I. Papendick. 1986. Estimating generalized soil-water characteristics from texture. Soil Sci. Soc. Amer. J. 50(4):1031-1036.

Appendix

Loading SSURGO Data

Soil data for a SWEEP simulation run may be obtained from the Natural Resources Conservation Service - Soil Survey Geographic (SSURGO) database file. Accessing this database will allow the population of many of the soil parameters on the SWEEP screen. Clicking on the SWEEP **'File'** menu and then clicking 'Load SSURGO File', opens a window titled '**Select SSURGO Soil**' (Fig. 1.9). Navigate through the database tree to find the soil survey area (or county) desired. Navigation is performed by clicking on the 'key' symbol to open the display to the next level of the tree. To close a level of the tree, click the 'key' symbol to close the level of the tree. The soil files are listed according to the soil map unit symbol, map unit name, surface texture, and local phase. Selecting a soil then displays its components and the percentage that each component contributes to the map unit. The user can choose to select the dominant soil for the field or selecth the most erodible soil of the field. Click on a soil component to highlight it and click the '**Select**' button Select at the top of the screen (or double click the component with the left mouse button). This action returns the user to the main SWEEP screen and converts the soil from the SSURGO database to a WEPS soil file format. SWEEP then loads the data into many of the Soil Layer and Soil Surface tabs. Clicking the '**Cancel**' Cancel button in the '**Select SSURGO Soil**' window aborts the selection of a new soil. The '**Question**' button opens the general help system for SWEEP.

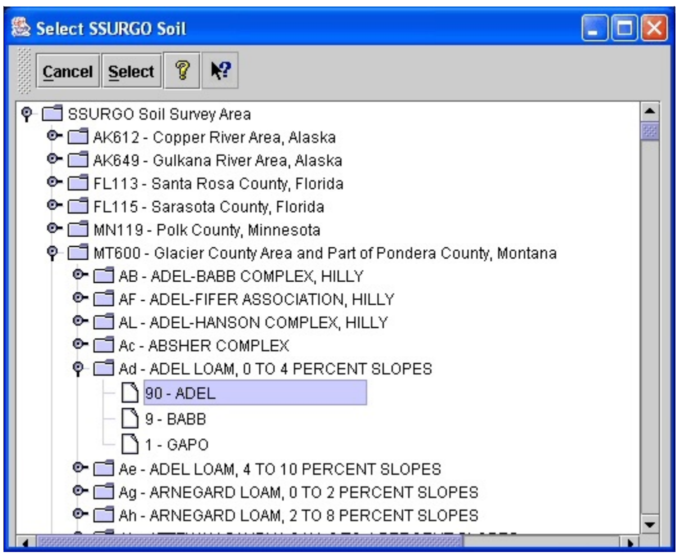

Figure 1.9. The 'Select SSURGO Soil' window.

Downloading SSURGO Soil Data

This section describes how to download soil data from the NRCS Soil Data Mart and how to extract it for use within WEPS and SWEEP. A Microsoft Access database is available for importing the data in the export file. You must have Microsoft Access 97 or later installed on your PC.

Soil data for NRCS and most other users in the US, is currently available for download from the NRCS Soil Data Mart at: http://soildatamart.nrcs.usda.gov/ . Soil survey data that is exported from the Soil Data Mart is in what is referred to as "SSURGO" (Soil Survey Geographic) format. To obtain soil data for a Soil Survey Area of interest, go to the Soil Data Mart and click 'Select State' at the top of the Soil Data Mart screen. Select the desired state then click 'Select Survey Area' or 'Select County'. Select the soil survey area, then click 'Download Data'. On the download screen select 'Tabular Data Only', select the version of Microsoft Access on your computer, and enter your e-mail address, then click 'Submit Request'. You will see a message stating "Your request has been logged. At a later time you will receive an e-mail with a link to download the export file. The format of an export file name is: soil_ssasymbol.zip, where ssasymbol is the soil survey symbol of the corresponding soil survey area.

After the export file has been copied to your PC, it must be unzipped by using either WinZip or a similar program. For additional information, please see the file named README.txt in the root directory that is created by unzipping the export file. For additional soil survey areas, each zip file should be copied and unzipped into individual directories. When an export file is unzipped, the following directory hierarchy is produced in the directory to which the export file was unzipped:

\spatial
\tabular

The top-level directory contains the following files:

soil_metadata_ssasymbol.txt - a Federal Geographic Data Committee (FGDC) metadata file in plain ASCII format.

soil_metadata_ssasymbol.xml - the same FGDC metadata file in XML format.

readme.txt - a text file containing additional information.

The root directory will also contain a zipped, empty MS Access SSURGO template database, if one was requested as part of the download. The non-extension part of the zipped template database file name varies, but if one was included, it will be the only file in the top-level directory with an extension of "zip". This file should be unzipped as well.

The directory "tabular" contains any tabular data that was requested. The directory "spatial" contains any spatial data that was requested. Note that spatial data is not required or recommended (due to large file sizes) for WEPS or SWEEP. It is possible to request tabular data from the Soil Data Mart without including the corresponding spatial data, and vice versa.

Tabular data is provided as a set of ASCII delimited files. Each file corresponds to a table in the SSURGO 2.1 data model. The tabular data isn't particularly useful until it has been imported into the MS Access SSURGO template database. Current Soil Data Mart downloads include a template database. If a template database was not included in the export file, you can download one from the following URL:

http://soildatamart.nrcs.usda.gov/templates.aspx

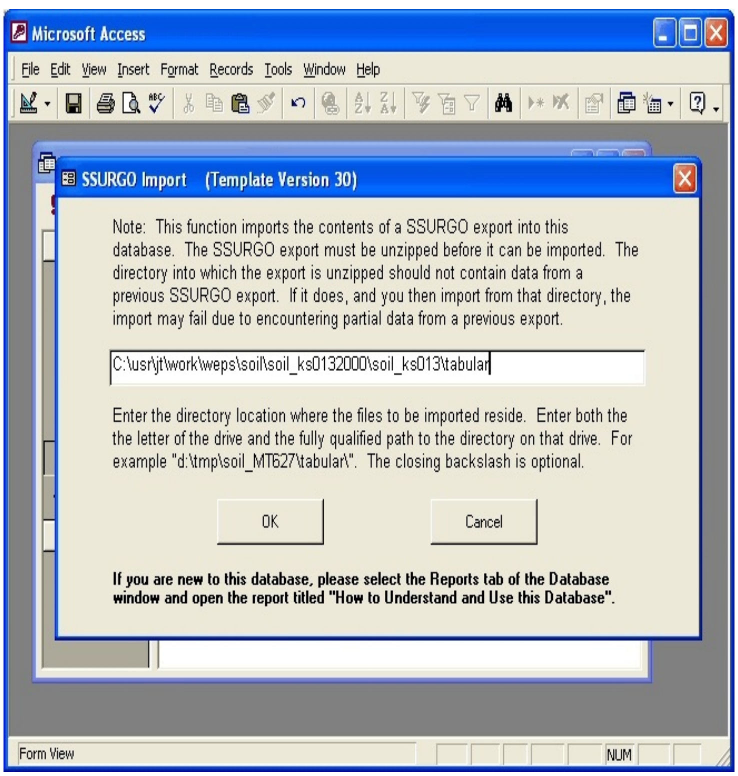

Figure 1.10. WEPS Soil User Interface screen.

To import tabular data, load the template file into MS Access. A 'SSURGO Import' screen will display, asking for the full path to the tabular data directory (Fig. 1.11). Type (or cut and paste) the full path of the tabular directory and click 'OK'. A list of database tables will appear and a folder will be created in the top level directory. The folder will have the base name (non-extension part) of the template name. At the same time, an MS Access database file (*.mdb), which contains the data required for WEPS, will be created in the template folder. To import more than one soil survey area into a single MS Access database, run the Import macro specifying the full path to the directory the SSURGO data was unzipped into. Repeat the Import macro for each area desired. When done, save the template database with the imported data to a new name (*.mdb).

The SWEEP interface extracts data from the following SSURGO data files located in the \tabular directory:

chfrags.txt
chorizon.txt
chtexgrp.txt
comp.txt
crstrcts.txt
legend.txt
mapunit.txt
muaggatt.txt
version.txt

If multiple soil survey areas are imported into a single MS Access database, the database may become very large. To reduce the size of the Access database file, one may run the Export macro and delete the SSURGO data (*.txt) files created in the tabular directory that are not listed above before importing into a template Access database.